

Selection Process of a Non-Primary Power Source for a Combat Vehicle

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Who is TARDEC?

- The U.S. Army **Tank Automotive Research, Development and Engineering Center** (TARDEC) is the nation's laboratory for advanced military automotive technology. Headquartered at the Detroit Arsenal, Warren, MI, TARDEC is located in the heart of the world's automotive capitol.
- Our mission is to research, develop, engineer, leverage and integrate advanced technology into ground systems and support equipment throughout the life cycle.
- TARDEC's 1,100 associates develop and maintain vehicles for all U.S. Armed Forces, many federal agencies and more than 60 foreign countries.

Who we provide service for

- TARDEC's most important customers are the men and women in America's Armed Forces.
- TARDEC programs serve all branches of America's Armed Forces. Specific Department of Defense elements TARDEC routinely serves includes:
 - Department of the Army Program Executive Offices
 - Army Materiel Command Product Managers
 - Army and Defense research laboratories
 - Army and Marine acquisition and contracting centers
- Various TARDEC programs also serve other Federal Government Agencies. To name just a few, TARDEC has relationships with the Department of Homeland Security, National Weather Service, Environmental Protection Agency and Treasury Department.

Introduction to TARDEC Mobility

- Our MISSION is to enable the Army to be a smart buyer of mobility systems
 - Best vehicles for the Army's mission
 - Ensure the best value for the Army
 - Insure Army has the Mobility advantage on the battle field with intelligent use of Power and Energy

- What We Do
 - Army's Technical Center for Ground Vehicle Mobility technologies
 - Provide superior mobility technologies (best can afford) and knowledge of technologies
 - Transition cost effective technologies

- How We Do It
 - Perform R&D of mobility technologies
 - Analyze, develop, test, report (Iterative design process)
 - Balance in-house and partners contributions
 - Systems engineering and program management

Supporting the Current Fight, the Current Force and the Future Force

Mobility's Focus Areas

- The TARDEC Mobility area is fully engaged with Army Transformation.
 - Mobility's support of the Current Force, with its Track Improvement Program Air Filtration Systems and other Auxiliary systems, is a key component of ground mobility in the theater of Combat.
 - Mobility is also supporting Future Combat Systems (FCS) as the Army's ground mobility experts.

- Organization – Mobility is functionally segmented into Eight integrated areas.
 - Hybrid Electric Research
 - FCS Mobility Project
 - Engines
 - System Integration / M&S / Test Ops
 - Track and Suspension
 - Fuel Cell Research
 - S&T Planning / New Business
 - Air Filtration/Transmissions/Cooling/Auxiliary Power

What is a Non-Primary Power Source (NPS)

- The capability to provide power from a source other than the main generator on a vehicle
 - Used both when the main generator is not providing sufficient power or the main engine is not operating
 - Power source includes storage, conversion or any other means to provide power other than the main generator
 - Battery
 - Engine/Generator
 - Fuel Cells
 - Etc.

Why is there a need for Non Primary Power?

- Over the past two decades, the electrical power needs of combats vehicles has increased with each system upgrade.
- While capabilities have been on the rise, the amount of power available has not always kept pace.
- Long term planning for non-primary power is now being used as a way ensure that the needs of the future are met in a timely manner today rather than rushed in the future.

Phases in Process

- Planning
 - Guidance
 - Forming the Team
- Gathering
 - Information
 - Personal Experiences
- Refinement/Assessment
- Out brief to Leadership

Guide Lines Used for Providing Non-Primary Power

- Near-Mid-Long term power needs of three target vehicles
- Improve the user capabilities without adding excessive burden
- Think about the system while designing components
- Use commonality across platforms where it makes sense to solve a common problem

Forming the Integrated Process Team

- A team comprised of experts familiar with both the vehicle systems and the technology available to meet the vehicle power needs was created.
 - Program Executive Office
 - Program Managers Office
 - TARDEC
 - Contracting
 - Acquisition

Vehicle Familiarization

- Line Replaceable Unit (LRU) list with power consumption
- Complete Operational Requirements Document (ORD) statements
- System Specifications
- Descriptions of ongoing power generation programs
- Modernization Plans
- Future Technology power profiles

Gap Assessment

Gap assessment focus on two areas in vehicle power consumption

1. Where are there gaps today?
2. What the future needs going to be?

Gap Assessment - Today

- Informational Analysis
 - Using the accumulated data from the vehicle familiarization, an analysis was performed to determine how, during a given upgrade, power consumption was planned for and accomplished in the past.
- User Input
 - A Voice of the Customer (VOC)/Quality Function Deployment (QFD) session was conducted with soldiers who recently returned from combat operations. Each soldier was encouraged to discuss issues experienced with the power systems on the vehicles. Data was collected and analyzed by the IPT.

Needs Assessment – Future

- Focused on when NPS technology should be inserted onto a vehicle.
 - Rebuild and Reset Schedules
 - Provides the most logical times to insert new technology onto a vehicle as entire units will be upgraded at the same time
 - Modernization Plans
 - Upgrades are planned to occur at specific times based on technology readiness
 - Future Needs
 - Plan to provide excess power now to meet the future need

Refinement of Requirements and Technology Assessment

- This phase signified a transition from the gather and analysis to refinement for possible material solutions
- Information previously gathered was combined with specific vehicle restrictions such a weight and space claim to form a preliminary NPS specification
- Potential solutions are gathered using
 - Internal Subject Mater Experts (SME)
 - Public Request for Information (RFI)

Presenting the Information to the Decision Makers

- Clear understanding of the process used to reach the conclusion
- Include concise Problem Statement, how the team was staffed and activities completed and ongoing
- Preliminary Material Solutions categorized from:
 - Cheap and Easy
 - Expensive and Difficult
- Recommended Path Forward is presented

Conclusions

- By following a traceable path, the decision making process was well documented
- Shortcomings in information were experienced, it provided the guidance to the team as to what is needed, why it is valuable, and how efforts should be made to produce this information for future use
- Unknown gaps were discovered during this process and can now be addressed
- While the process is not perfect or complete, it is the basis for ongoing work and will continue to be used on this and other ongoing projects
- System Engineering principles must be used when looking at vehicle improvements